

GUIDELINES
FOR
TRAFFIC IMPACT STUDIES
AND
AIR QUALITY ANALYSIS
IN
JEFFERSON COUNTY, KENTUCKY

Prepared by:

Public Works and Transportation Division
and Air Pollution Control District

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JEFFERSON COUNTY PUBLIC WORKS AND TRANSPORTATION DIVISION
AND AIR POLLUTION CONTROL DISTRICT OF JEFFERSON COUNTY

**GUIDELINES FOR
TRAFFIC IMPACT STUDIES AND AIR QUALITY ANALYSIS IN
JEFFERSON COUNTY, KENTUCKY**

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JEFFERSON COUNTY PUBLIC WORKS AND TRANSPORTATION DIVISION
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I. INTRODUCTION

The Louisville and Jefferson County Planning Commission requires that all traffic data and/or analysis either by a project proponent or opponent must be first reviewed by the Jefferson County Public Works and Transportation Division. This is to insure compliance with these guidelines and the comprehensive plan.

The purpose of this document is to provide guidance to developers and consultants regarding traffic impact studies and air quality analysis submitted as attachments to proposed development plans in Jefferson County, Kentucky. These studies can be useful decision making tools and, when warranted, are an important component of a development petition. These guidelines are intended to provide consistency in the preparation of impact studies. They are provided as a reference only. The analysis required for a traffic impact study should be conducted only under the supervision of a transportation engineer with specific training in traffic engineering. The air quality analysis should be conducted only by a professional certified by the Air Pollution Control District.

Notes which provide definitions for the technical terms discussed herein and those that should be addressed in an impact study are included in Appendix A. Elements of a recommended impact study are presented in Appendix B and sample traffic analysis forms are shown in Appendix D. The emission data required for air quality analysis generated by the Air Pollution Control District is presented in Appendix E. The major acceptable sources of information and reference are presented in Appendix F.

II. WARRANTS FOR REQUIRING AN IMPACT STUDY

The Jefferson County Public Works and Transportation Division (PW&T), as the initial step in the review process of a proposed development plan, will evaluate the need for a traffic impact study. The need for a traffic impact study will be determined on a case-by-case basis. The criteria described below will be used by the PW&T staff in its recommendations of need for a traffic impact study. The final decision to require a traffic impact study will be determined by the Director of Public Works, based on staff recommendations. If a traffic impact study is determined to be necessary, a report of the study's findings must be transmitted to and reviewed by PW&T staff before a recommendation on the proposed development plan will be made to the Planning Commission. For air quality concerns the APCD shall determine when an analysis performed by or for the developer is required. In most instances a traffic and air quality impact study would be jointly performed, however, either or both may be waived when conditions warrant.

The normal maximum time required for review and comment is two weeks. Should action be required of the APCD's Board this time would be extended to be compatible with the Boards regular monthly meeting every third Wednesday. An impact study may be requested if any of the following conditions are present:

- A. Significantly Sized Project: The proposed development is of sufficient size to have a substantial impact on a particular local area. The proposed development is considered to meet this criteria if it generates two hundred (200) or more peak hour trips according to the current editions of Trip Generation, published by the Institute of Transportation Engineers, locally generated data or other acceptable source.
- B. Nearby Congestion: The proposed development, of any size, is located near roadways, intersections or set of intersections which have been identified by the Director of Public Works as being already heavily congested.
- C. Modification to Roadway: When the proposed development is located near a roadway segment identified by the Director of Public Works as within a problem area, needing to be widened or improved. This criteria will also be satisfied if the proposed development plan includes modifications to the State or County roadway system.
- D. Traffic Control Signal: This warrant will be satisfied if the proposed development plan includes the installation of a new or the modification of an existing traffic control signal.
- E. Air Quality: The proposed development is located in or will affect potential "Hot Spot" area, as identified in the Core Graphics of the Comprehensive Plan or an area of special air quality concern.

III. RECOMMENDED CONTENTS OF AN IMPACT STUDY

The developer shall be responsible for all data collection, analysis, and reporting associated with the traffic and air quality studies. The results of the developer's efforts will be reviewed by PW&T and APCD for content, results and acceptability. A single report documenting the traffic and air quality studies should be prepared. Traffic should be presented first since air quality analysis is dependent on traffic data.

A. Traffic Impact

Generally a traffic impact study will provide operating capacity and level of service analysis for critical roadway segments and/or intersections within a predetermined impact area. Upon determination that a traffic impact study is required, the PW&T staff, with the petitioner, will identify the area of impact, the critical intersections to be analyzed and the scope of the study. Capacity and level of service analysis will be conducted for the following conditions:

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1. Existing traffic, to establish the current conditions as a point of reference;
2. Existing plus expected natural traffic growth, and approved development projects not yet completed, if any, to establish the short term future traffic conditions without the proposed development;
3. Full development traffic condition (including existing traffic, expected natural growth, approved development projects, and expected site generated traffic), to estimate future traffic conditions once the project is completed.

[NOTE: If the proposed development is expected to be constructed in phases, over a period of years, analysis for each phase of development must be provided for each of the above conditions and should include a predetermined rate for natural growth of through traffic.]

If the proposed development includes a request for rezoning, the study should also include an analysis comparing the traffic generated by the proposed development with the traffic generated by the existing zoning or land use/zoning recommendations in Corridor Plans or Neighborhood Plans. This analysis should be very brief, possibly consisting only of a table comparing the expected number of new trips generated by the recommended zoning and the proposed development plan. In addition, a short narrative should be present comparing the percentage or basic differences between the two scenarios.

The individual parameters of the traffic impact study will be agreed upon during an initial review meeting between the petitioner and PW&T staff. These parameters may include, but not be limited to, the following:

1. Boundary of the traffic impact area;
2. Roadway segments and critical intersections to be included in the traffic impact study;
3. Adequacy of available turning movement counts and need for additional data;
4. Period of analysis (A.M. and/or P.M. peak hour weekday and/or weekend, depending on the development);
5. Trip generation rates or acceptable sources to be used;
6. Reductions to driveway trips due to internal circulation (if applicable);
7. Percentage of trip reassignment to account for pass-by and diverted traffic.
8. Directional distribution of site-generated traffic;
9. Mode split assumptions (if applicable);
10. Programmed projects in KIPDA's Transportation Improvement Program, the Comprehensive Plan's Core Graphics, along with travel demand estimating procedures for any assumptions relating to traffic diversion to new programmed facilities;
11. Roadway capacity and trends in traffic growth;
12. Acceptable methodologies to be used;

13. The range of feasible traffic engineering and operational improvements associated with the development;
14. Feasibility of including measures in the development proposal to promote transit ridership. This would require coordination with TARC *and* may include such provisions as transit stops and shelters with adequate pedestrian access, park-n-ride lots.
15. Possibility of implementing other transportation system management strategies such as flex-time and variable work hour programs to redistribute peak hour traffic, employer ridesharing programs, preferential parking for ridesharers, etc.;
16. Possibility of implementing provisions for alternative modes of transportation, such as bikeways, pedestrian walkways, including the provision of sidewalks along State Highways and along the County through roads system.
17. The identification of high accident locations; and
18. A formal cost estimate of mitigation measures, (including construction, design, right-of-way and utility relocation cost). Approval of the above parameters must be given by the PW&T at this initial meeting. It is recommended that the developer, or his representative, document the discussions at this meeting and submit a letter of conformation to PW&T for approval. This confirmation should be obtained prior to the beginning of analysis. Failure to obtain approval for the methodologies, parameters or assumptions used, in the traffic impact study, may result in rejection of the entire study by PW&T.

Proposed site plans should be submitted to APCD and PW&T as soon as possible. The Public Works and Transportation Division will then coordinate, for APCD, the collection and analysis of all traffic data, by the developer. A representative from APCD will be asked to attend the initial meeting discussed above and will be informed of all meetings, which may affect air quality, throughout the review Process.

No traffic data, however, will be submitted to APCD by the developer. All existing and expected traffic data will be submitted to and review by PW&T. The Public Works and Transportation Division will forward, to APCD, only traffic data required for air quality analysis. Any discussions between the Developer and APCD, concerning site or general traffic related issues, must be coordinated through the Public Works and Transportation Division.

Should any of the proposed development's ingress/egress points be located on a roadway controlled by the Commonwealth of Kentucky, the petitioner is recommended to contact the Kentucky Department of Highway's district office, (District 5). A copy of the proposed development site plan should be submitted to the District Permit Engineer. The District Permit Engineer will be informed of all meetings concerning traffic issues and asked to attend. A copy of the traffic impact study, (both draft and final), report should be submitted to the District Permit Engineer for their review and comment. Proposed mitigation measures, if any, on roadways controlled by the State must be approved by the District Permit Engineer before approval by PW&T will be granted and recommendations to the Planning Commission will be made.

B. Air Quality Analysis

The traffic impact study will generate a substantial amount of data required for the air quality analysis. The traffic data used for the air quality analysis must be identical to that used for traffic analysis. Coordination of all traffic studies shall be the responsibility of PW&T, even in those cases when only an air quality analysis is performed. Upon determination an air quality analysis is required the APCD staff will identify the intersections to be analyzed. These may or may not be the same intersections identified by PW&T for traffic analysis.

Prior to beginning any air quality analysis the petitioner will attend the initial review meeting where APCD staff will be available to discuss the petitioner's air quality analysis plan. At that meeting data collection, analysis techniques, assumptions, and products shall be discussed. The following study elements relative to air quality will be covered:

- 1) APCD's certification process for air quality analyst;
- 2) Relationship between traffic studies and air quality studies;
- 3) Critical intersections included for air quality analysis;
- 4) Criteria for locating receptors;
- 5) Acceptable air quality model;
- 6) Intersection drawing requirements;
- 7) Emission rates from MOBILE 5 a;
- 8) Traffic counts needed for persistence factor;
- 9) Assumptions for meteorological condition;
- 10) Background emission levels;
- 11) Mitigation of air quality impacts; and
- 12) National Ambient Air Quality Standards;

The guidelines set forth in this document and those discussed at the initial review meeting shall be followed. Any proposed deviation from the guidelines shall be well documented and thoroughly justified in writing prior to their use. Mitigation measures should be developed with consideration given to their effects on traffic and air quality. Although most mitigation measures that improves traffic flow also improves air quality, this is not true for all mitigation measures.

Mitigation measures should be clearly identified and should be implementable. Before a mitigation measure can be accepted there must be a formal enforceable agreement with the party responsible for implementation.

IV. HOW THE IMPACT STUDY WILL BE USED

The Jefferson County Public Works and Transportation Division staff will relate the findings from the traffic impact study to the following:

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- A. Changes in operating delays, levels of service and volume-to-capacity ratios;
- B. Cost of making any necessary improvements to the transportation system;
- C. Comparing the impacts of a proposed rezoning with those which would occur by adherence to the Comprehensive Plan;
- D. Assessing the necessary capacity of the transportation system in the context of a fully developed impact area; and
- E. Improvements proposed by the petitioner to mitigate traffic impacts.

The Air Pollution Control District staff has one major concern: Whether the air quality model predicts an exceedence of the National Ambient Air Quality Standards. Also of concern is the impact on the identified potential "Hot Spots".

Major conclusions reached by the PW&T and APCD will be discussed with the petitioner and incorporated into the staffs' comments and reported to the Louisville and Jefferson County Planning Commission. Three (3) copies of the final study report shall be submitted, by the petitioner, to the Jefferson County Public Works and Transportation Division, two (2) copies to the Air Pollution Control District of Jefferson County, and one (1) copy to the Planning Commission at a minimum of two (2) weeks prior to its Land Development and Transportation (LD&T) Committee, which is held on alternating Thursdays. Where applicable one (1) copy should be submitted to the District permit Engineer at the Kentucky Department of Highways' District 5 Office. Information presented within the final report, backup supporting data and staff comments from PW&T and APCD, will be made available to concerned citizens of Jefferson County requesting this information. A detailed description of the information to be included and a typical outline for the final report is presented in Appendix C. In addition, the study may be used by the PW&T staff to identify needed transportation improvements, right-of-way requirements and the potential for developer contributions to needed improvements. Written commitments regarding these issues may be incorporated, for plan approval, in the form of binding elements by the developer.

Based on this analysis the APCD will make recommendations to the Planning Commission, in regards to the proposed development's impact on air quality. Any negative recommendation must have official approval of the APCD Board. Traffic improvements required to reduce the developments impact on air quality may be identified, with the assistance of PW&T. If these mitigation measure represent sound traffic engineering practices, they may be incorporated into proposed binding elements for the approved plans.

APPENDIX A TECHNICAL NOTES

- A. Trip Generation:** Average trip generation rates or regression equations for the peak hour of the adjacent street will be obtained from the current edition of the Institute of Transportation Engineer's Trip Generation Manual or Local Trip Generation Study published in October 1993. Other local data may be acceptable provided it was collected using recommended methodology and can be properly documented.

- B. Peak Hour Percent:** A peak hour percentage of 10 percent of the daily trips will be assumed for existing traffic unless hourly counts are available.

- C. Peak Hour:** The petitioner shall use the peak one hour period which occurs during either 7-9 A.M. or 4-6 P.M. periods or both, as agreed to by the staff and petitioner. In some cases, however, the PW&T staff may require additional hours, for example, Friday nights or Saturday afternoon, to also be analyzed.

- D. Directional Split:** The directional split of the entering and exiting traffic associated with the development will be derived from the ITE Trip Generation manual unless other acceptable locally generated data is available.

- E. Pass-by Trips:** The percent of pass-by-trips shall be applied to the trips generated by the proposed development and assigned to the adjacent street network. This rate does not affect the proposed project's driveway volumes but rather reassigns existing trips to movements entering and exiting the proposed development. The pass-by trip rates will be agreed upon during the preliminary meeting. The following pass-by trip rates have been determined for some land uses in Jefferson County:

Retail	30-35%
Quality and Sit Down Restaurants	25%
Fast-Food Restaurants	30-50%
Banks	55%
Convenience/Gas Stations	55-60%

These rates were determined as part of a Local Trip Generation Study. The use of these rates are recommended, however, the developer may supply additional information for review and consideration.

- F. Diverted Linked Trips:** A reassignment for diverted trips will generally occur outside the impacted study area; therefore, for the purpose of these traffic impact studies, diverted trips would be considered "new trips" within the study area and can be ignored in most cases. This factor, if applicable, will be decided during the preliminary meeting.

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- G. Internal Circulation Trips:** Reductions for internal circulation trips are applicable for projects such as shopping centers with out-lots and represents a reduction in projected driveway trips. The internal circulation trip rate will be agreed upon during the preliminary meeting and shall not exceed 10 percent.
- H. Trip Distribution:** The directional distribution of the generated trips entering and exiting the proposed development via all access points must be justified by the relative locations of other traffic generators (e.g., employment centers, transportation terminals, etc.) and/or trip table information. These factors, or other factors agreed upon by the staff, shall be applied to the traffic generated by the proposed development as well as the traffic generated by nearby approved projects.
- I. Trip Assignment:** The distribution factors shall be applied to the trips generated by the proposed development and nearby approved projects and assigned to the existing traffic on the road network providing access to the proposed development.
- J. Capacity Analysis:** At the identified critical intersection(s), the existing and generated traffic is to be related to the adequacy of the intersection by using the techniques described in Chapters 9 and 10 of the 1985 Highway Capacity Manual. Special Report 209. The PW&T staff has the necessary computer program to review and verify this analysis. Link volume analysis shall also be related to the Highway Capacity Manual standards. The analysis should be carried out for the A.M. and/or P.M. peaks, as agreed to by the staff and petitioner. This analysis should use traffic data for non-holiday weekdays, unless specifically requested by PW&T staff to analyses other periods. It is also recommended that the operational methodology be used in the analysis of signalized intersections. If so desired, alternative capacity and level of service analysis techniques may be used, provided data is presented in such a form that the results may be duplicated using the latest version of the Highway Capacity Software and Signal Software sponsored by FHWA and McTrans, respectively.
- K. Traffic Data:**
- 1 Traffic volume data IS NOT available from PW&T at this time. Average Daily Traffic volumes, turning movement counts and traffic control signals data on roadways maintained by the Commonwealth of Kentucky MAY BE available from the Department of Highways or KIPDA. The above sources should be contacted concerning the availability of traffic data. If, however, acceptable data is not available, the petitioner is responsible for obtaining such data.
 2. Traffic count data should be adjusted to the current year, or new counts should be made by the applicant if, in the opinion of the PW&T staff, traffic volumes have significantly increased due to some change(s) in the traffic pattern, such as the completion of a development project after the count was made.
 3. If turning movement data is outdated or if there are locations for which data is non-existent, data must be acquired at the applicant's expense.

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4. Intersection traffic counts conducted by the petitioner should be comprised of manual turning movement counts covering the period of 7-9 A.M. and 4-6 P.M. in order to allow for the selection of the peak hour within the nearest fifteen minutes (e.g., 4:00-5:00, 4:15-5:15, etc). The inclusion of all 7-9 A.M. and 4-6 P.M. turning movement data is requested as part of the petitioner traffic impact analysis., Summaries of each fifteen minute period should be submitted, under separate cover, to PW&T. (A typical turning movement count summary form is present in Appendix D.)
5. Ideally the traffic analysis should be performed for the design hour which represents the 30th highest hourly traffic volume on an annual basis. However most peak hour traffic volumes counts in urban areas closely approximate the 30th highest hour. Exception to this generalization are when special events occur, holidays (and holiday periods), and the month of December. Although these periods should be avoided for traffic counting, on occasions because of scheduling considerations counts are made. Such counts should be adjusted to approximate the 30th highest hourly traffic volumes. Historical counts and staff knowledge of the area will be used to judge the adequacy of counts used by the applicant.
6. If the proposed development includes plans for the installation of a new traffic control signal, the petitioner must conduct a Traffic Signal Warrant Analysis. This analysis would produce documentation that indicates the conditions at the proposed location warrant a traffic signal by meeting the recommended minimum warrants presented in the Manual for Uniform Traffic Control Devices. (MUTCD). Documentation of this analysis should be included in the appendix of the final report and should include, but not be limited to, the methodology used, daily traffic count data used in the analysis, and the resulting capacity analysis results at this location. A simple analysis form is presented in Appendix D.

L. Adequate Accommodation of Traffic: The ability of a highway system to carry traffic is expressed in terms of volume-to- capacity (V/C) ratios and level of service at the critical locations, usually intersections. The V/C ratios clearly define the degree of saturation at an intersection. A V/C ratio of 1.0 indicates that the intersection is operating at its theoretical capacity, that is, the traffic volume demand equals the estimated number of vehicle that may pass through the intersection in a given period of time. A value of over 1.0 depicts a situation where the demand exceeds the intersection's capacity and operational problems exist, either in geometries or signalization. As the V/C ratio approaches 0.9, breakdowns in the operational efficiency of the intersection tend to develop. When the V/C increases above 0.9, operational breakdowns also increase in frequency and may result in a high level of delay to motorists.

In considering mitigation measures, the change in V/C ratio and level of service must be taken into account as well as the actual V/C values for individual approaches and the overall intersection. If no mitigation exists or if the improvements required are beyond what could reasonably be expected from the petitioner, then negotiations between the petitioner and PW&T staff members will be conducted to determine the level of petitioner responsibility for improvements at the intersection.

Level of service for signalized intersections is defined by the Transportation Research Board's Special Report 209, 1985 Highway Capacity Manual, in terms of delay. Generally, delay is considered a measure of driver discomfort, frustration, lost time and fuel consumption. Delay at signalized intersections is a result of a number of factors, including the signal's cycle length, phasing, progression in relation to other signals, traffic volumes and the intersection's lane configuration and geometries. Although they are an important consideration in intersection analysis, delay and level of service results should not be used in determining mitigation measures. The PW&T staff will rely primarily on the V/C ratio in determining the effectiveness of proposed mitigation measures.

"Levels of service" as defined by the 1985 Highway Capacity Manual are presented in Table A-1.

- M. Air Quality Analysis Model:** The recommended model for roadway and signalized intersections is CAL3QHC. A copy of the computer program and user's guide prepared by the U.S. Environmental Protection Agency may be purchased from Pollution Control District. CAL3QHC is a microcomputer-based modeling methodology developed to predict the level of carbon monoxide (CO) emitted from motor vehicles traveling near roadway intersections.
- N. Mapping:** The application of the CAL3QHC model requires a scale drawing of each critical intersection. It is recommended that the scale be 1" = 50'. Alternative scales may be considered at the initial review meeting. When a grid system is placed on the scale drawing the spatial relationship between the driving lanes and receptors may be replicated within the computer model. A transparent grid has been successfully used on recent projects. The drawings should provide existing lane configuration, lane widths, and location of all-rights-of-way. Contour lines and spot elevations also must be presented on each drawing. Separate drawings showing existing and proposed conditions should be provided. Copies of these drawing should be submitted along with the impact analysis report.
- O. Receptor Location:** The receptors should be located where the maximum total projected concentration is likely to occur (not on the roadway itself). As a rule a receptor should be located outside the "mixing zone" of the travel lanes. The distance from the travel lanes should be 10 feet (3 meters) or at the right-of-way line (if no people generating activity occurs within the right-of-way), whichever is the greatest distance.

All space outside the right-of-way is considered to be available to the general public whether or not it is presently used. A dedicated buffer zone boundary legally identified for landscaping purposes on which routine public access is not intended may be used to locate receptor locations rather than the right-of-way line.

- P. Free Flow Speeds:** At an intersection, vehicles are considered to be idling when the traffic signal is red, all other times the vehicles are considered to be in a free flow mode. The speed for a free flow link represents the speed experienced by drivers traveling along the link during the time the traffic signal is not red. A free flow speed must be assigned to each link.

Based on the posted speed limit the following speeds should be used as default values:

<u>Posted Speed (mph)</u>	<u>Free Flow Speed (mph)</u>
55	40
45	35
40	30
35	25
25	20

Actual free flow speeds may be substituted for the above default values based on an acceptable documented study. The techniques in Chapter 9 of the Highway Capacity Manual (TRB 1985) to estimate adjusted vehicle speed may be used.

- Q. Emissions - MOBILE 5 a:** Separate emission rates are used as input data to CAL3QHC for each free flow and queue link. The U.S. EPA mobile source emission factor model (MOBILE 5 a) has been applied by APCD to generate both free flow and idling emission rates. Appendix E contains approved emission rates for the years 1991 through 2000. No other emission rates may be used without prior approval, in writing, of APCD.
- R. National Ambient Air Quality Standards:** The ambient air quality standards for carbon monoxide applicable in Jefferson County are the following Federal Standards.

One Hour - 35 ppm or 40 mg/m³

Eight Hour - 9 ppm or 10 mg/m³

These values may not be exceeded more than once per year. Any modeled concentrations above 35 ppm or 9 ppm is considered a violation.

- S. Persistence Factor:** The CAL3QHC model is to be used to predict the one-hour worst-case concentrations. A persistence factor is used to convert the one-hour worst-case modeling results to a

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predicted 8-hour average concentration. The persistence factor **primarily** accounts for the variation in traffic over the eight hour period and can be estimated by using traffic counts made over the eight hour period on each leg of the intersection. These counts may be made with an automatic traffic counting machine, manual counts are not necessary. The persistence factor is determined by dividing the average of the eight highest hours by the peak hour. The calculated factor shall be used if it is greater than 0.60 or less than 0.80. if lower than 0.60 use 0.60 and if greater than 0.80 use 0.80. The eight highest hours must be continuous and must contain the peak hour.

The counts on the legs of the intersection should be summed for this calculation to determine one overall persistence factor for each intersection. The calculations used to determine the persistence factor shall be documented in the impact study report.

- T. Background Concentrations:** All concentrations of carbon monoxide that are not emitted by the sources being modeled are background concentrations. They can be wind blown from far away or from nearby sources such as parking lots and adjacent intersections. The following background concentrations (one hour) should be used for the conditions described:

Condition	<u>Background Concentration (ppm)</u>
1) CBD or intersection with congested adjacent intersection(s) and nearby parking facilities.	3.0
2) Intersection with nearby parking facilities	2.0
3) Isolated intersection (no nearby congested intersection or nearby parking facilities).	1.5

The use of background concentrations other than the above must receive prior approval, in writing, of the APCD.

- U. Meteorological Conditions:** The CAL3QHC User's Guide discusses various meteorological parameters that are input to the model. The following values or responses shall be used for air quality analysis in Jefferson County.

Wind Speed	1 Meter/Second
Wind Angle	0°
Multiple Wind Angles	Yes
Increment Angle	10°
First Increment Multiplier	0
Last Increment Multiplier	36
Mixing Height	1000M
Stability Class	D

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Surface Roughness	
CBD	321 cm
Office Area	175 cm
Suburban Area	108 cm

TABLE A-1

LEVEL OF SERVICE CRITERIA FOR SIGNALIZED INTERSECTION

LEVEL OF SERVICE	DESCRIPTION
A	Describes operations with very low delay, i.e., less than 5.0 seconds per vehicle. This occurs when progression is extremely favorable, and most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.
B	Describes operations with delay in the range of 5.1 to 15.0 seconds per vehicle. This generally occurs with good progression and/or short cycle lengths. More vehicles stop than for LOS A, causing higher levels of average delay.
C	Describes operations with delay in the range of 15.1 to 25.0 seconds per vehicle. These higher delays may result from fair progression and/or longer cycle lengths. Individual cycle failures may begin to appear in this level. The number of vehicles stopping is significant at this level, although many still pass through the intersection without stopping.
D	Describes operations with delay in the range of 25.1 to 40.0 seconds per vehicle. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high V/C ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.
E	Describes operations with delay in the range of 40.1 to 60.0 seconds per vehicle. This is considered to be the limit of acceptable delay. These high delay values generally indicate poor progression, long cycle lengths, and high V/C ratios. Individual cycle failures are frequent occurrences.
F	Describes operations with delay in excess of 60.0 seconds per vehicle. This is considered to be unacceptable to most drivers. This condition often occurs with over-saturation, i.e., when arrival flow rates exceed the capacity of the intersection. It may also occur at high V/C ratios below 1.00 with many individual cycle failures. Poor progression and long cycle lengths may also be major contributing causes to such delay levels.

SOURCE: Highway Capacity Manual. Special Report 209, Transportation Research Board, Washington, D.C., 1985.

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APPENDIX B STUDY ELEMENTS

The following items should be included in the impact studies submitted to the Jefferson County Public Works and Transportation Division and the Air Pollution Control District of Jefferson County.

A. Text

The text should be brief and to the point. It should be presented in numbered sections which contain the information as outlined below:

Part One: Traffic Impact Studies

Section 1: Introduction — this section should identify clearly the developer of the proposed development and the consultant performing the analysis. It should also provide a description of the site's location, using a location map to depict its location in Jefferson County. In addition, this section should detail the site's current zoning, any proposed zoning changes, zoning of the surrounding area and the total acreage to be developed. The Comprehensive Plan recommendations for the proposed site should also be described in this section. In addition, this section should briefly describe the proposed project in terms of total square footage, by land use, or the number of dwelling units to be constructed. This description also should include the proposed construction schedule and the number of units, by land uses, to be constructed in each development phase.

Section 2: Section two of the report should describe the data collection process, that is, the type of data collected and when, if necessary, traffic counts were taken. This section should also include a description of the relationship between the site and the existing transportation system. This should include driveway locations, existing geometry, average daily traffic, lane configurations, traffic control devices at critical intersections, and existing and expected future functional classifications, as presented in the Comprehensive Plan Core Graphics. If applicable, the availability of public transit to the site should also be discussed.

Section 3: This section should indicate the procedures used in the analysis, street segment(s)/intersection(s) to be analyzed, trip generation rates used and their source, time period(s) to be analyzed, and the range of trip reassignments for pass-by, diverted, and trip reductions for internal circulation, identifying the source of the rates used, expected traffic entering and exiting the site, and the assignment of those trips to the street system, expressed as a percentage of total new trips generated.

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Section 4: Discussion of the results for each condition analyzed should be submitted in section 4. A subsection should address committed roadway and intersection improvements in the area and their effect on the proposed development. If the street segment(s)/intersection(s) are scheduled for improvement, a description of these improvements and the expected completion date should be included. Planned roadway or intersection improvements may also be identified in this section. However, planned improvements may not be considered in the analysis of the proposed development. Only projects committed to by the state, county or local jurisdiction should be considered. In addition to committed improvements additional mitigation measures should be identified, if necessary. Analysis should be conducted and compared with results without these measures. Tables comparing the analysis results; should be presented within this section, and detailed result should be presented in the appendices of the report.

It should be the goal of any proposed mitigation measure to maintain an acceptable V/C ratio and level of service at all critical intersections. Whenever feasible, mitigation measures should be developed to ensure that resulting conditions at the critical intersections are no worse than currently exist or are expected to exist with committed improvements without the proposed development. It is realized that this is not always possible or desirable; therefore, the main objective is to maintain an acceptable V/C ratio for the intersection. Detailed supporting data and analysis results used in the determination of mitigation measures should be submitted to PW&T under separate cover.

Section 5: The final section should briefly describe the roadway system's ability to handle the traffic generated for each condition analyzed. Identify needed street improvements over and above those currently programmed and a reasonable cost estimate for making the improvements. This section should also be used to document reasons for those street improvements above those currently programmed.

Part Two: Air Quality Analysis

The air quality analysis should be well documented, however, the text should be brief. The CAL3QHC modeling printouts provide most of the details needed for review and verification by the APCD. A diskette containing the data used for the CAL3QHC model runs should be provided. The text of the impact report should summarize the analysis. The certified air quality analyst should be identified in the report.

Section 1: Briefly described the process and in making the air quality analysis. If the procedure in the guideline were followed, a statement to that effect is all that is needed for this Section. Tables or maps describing the input or output of the model should be referenced. Should a value not recommended in the guidelines be used, the full documentation justifying the deviation should be presented here. (Caution: Although the documentation is presented in this report the approval to deviate from the guidelines must be obtained prior to the analysis.)

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Section 2: The conclusions and findings relative to air quality are presented here. Mitigation measures proposed by the developer to reduce air quality impacts should be described. If the mitigation measure is to be implemented by someone or agency other than the developer an official statement must be included (letter of commitment) from the other party.

B. Maps

The following maps, as a minimum, should be provided for reference with the impact study report submitted for review and acceptance.

1. An area or location map which locates the proposed development in the context of the existing area wide street system.
2. A site plan of the proposed development which identifies the proposed land uses, access to the site from the existing roadway system, the proposed internal circulation system, parking layout and parking breakdown, (number of spaces required and number of spaces provided), as defined in **Article 10** of the **Louisville/Jefferson County Zoning Regulations**.
3. A map of the traffic impact area which identifies existing roads in the area, the proposed development, critical intersections and other approved projects in the area using the following status categories:
 - a. **under construction**
 - b. **zoning and/or construction approval**
 - c. **proposed, but not yet approved.**
4. A map which identifies committed roadway improvements, if any, that are included in the Regional Transportation Improvement Program, the Commonwealth of Kentucky's Six Year Plan or identified by the Director of Public Works, which may affect traffic at the critical intersection(s) being studied.
5. A map which identifies existing A.M. and/or P.M. peakhour traffic volumes assigned to the affected street system. (**NOTE:** Both volumes, if needed, may be presented on the same map).
6. A map which identifies the trip distribution pattern, as a percent of total traffic generated, for the proposed development during the time period(s) agreed upon.
7. A map which identifies the trip distribution pattern, as a percent of total traffic generated, for approved projects in the impact area during the time period(s) agreed upon.
8. A map which identifies the actual traffic volumes generated by the proposed site and

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other approved projects within the impact area assigned to the affected street system for the time period agreed upon. The map should distinguish between the two sources of traffic and identify the sum of the two.

9. Scaled drawings (1" = 50') of critical intersections with a grid overlay showing the location of the receptors, distance to adjacent intersections, length of storage lanes, and location of stop bar.

C. Tables and Figures

The following is a minimum list of tables and figures which should be included in a traffic impact study within Jefferson County.

1. A table which provides the following information about the land uses/trip generation characteristics of the traffic impact area identified in Map 3.
 - a. ITE land use code used in the study;
 - b. Units to be developed (sq. ft., D.U., etc);
 - c. Trip generation rate/trip ends generated (for the adjacent street peak hour, entering/exiting the facility for the period(s) analyzed);
 - d. Reassignment rates for pass-by, and diverted trips and reduction rates for internal circulation;
 - e. Total new Trip ends added to the new existing (and/or committed) street system.
2. A table which summarizes the volume-to-capacity ratios delay and level of service for each of the critical intersections, by approach and movement, for each of the conditions analyzed.
3. Diagrams of the existing geometry and lane utilization for the road segment(s) and/or critical intersection(s) being analyzed.
4. Diagram of the improved geometry and lane utilization for the road segment(s) and/or intersection(s) being analyzed. Diagrams identifying both planned improvements and mitigation measures should also be provided.
5. A receptor location description table (including coordinates).
6. Tables showing maximum 1-hour and 8-hour concentrations (including background) at each receptor point.
7. Modeling printouts with input listing and output files showing maximum concentration calculated. Should be submitted as a separate document.

D. Appendix

The appendix should include the output summary from the Highway Capacity software, or, if other procedures are used, equivalent documentation which would permit PW&T staff to easily replicate the procedures. Documentation should be provided for each condition analyzed. (Detailed results from the Highway Capacity Software should be provided under separate cover to PW&T).

All relevant data necessary to conduct an analysis using the Highway Capacity software should be provided within the appendix. This data includes assumptions or actual counts of truck and transit traffic, right turns on red, pedestrian traffic and parking maneuvers. This data should also include a diagram showing the assumed phasing and timing for each signalized intersection analyzed. (If actual signal phasing and timings are used, phasing diagrams and time charts should be provided under separate cover to PW&T).

If the intersection level of analysis is being performed, existing intersection turning movement counts for the time period(s) analyzed should be included for each intersection. The counts should be presented in such a fashion that the PW&T staff may determine the peak traffic hour for the time period(s) analyzed. In addition, expected peak hour turning movement counts should also be provided for each critical intersection for the total build condition. If the project is to be constructed in phases, expected peak hour turning movements should be provided for each phase. A sample turning movement summary sheet is provided in Appendix D, Figure 2. This example provides a summary of all data required to determine the expected peak hour turning movements.

It is also requested that copies of the original turning movement field sheets be provided, under separate cover, to the PW&T staff. It is requested that these counts be summarized in 15 minute intervals. The purpose of this request is to develop a historical turning movement count file throughout Jefferson County. This data will be useful in more accurately determining the impacts of future development in the area and provide Jefferson County and developers with an accessible traffic count database. The recommendation for the installation of a traffic control signal and the estimated cost for installation should be presented within the text of the report, with other recommended improvements.

If the petitioner or the consultant feels that the installation of a new traffic control signal is warranted, documentation supporting this recommendation should be provided in the appendix. This documentation should include a discussion of the signal warrant expected to be satisfied and the methodology used in that determination. This narrative should be supported with tables and figures that clearly present any assumptions, calculations and results used in the analysis. Reference material used for this analysis should also be noted.

In addition, possibilities of providing an interconnect signal system or to provide optimum signal progression should be discussed. Figure 3 of Appendix D provides an example of the type of table that should be present in this analysis to support the justification of signal installation.

**APPENDIX C
TYPICAL TRAFFIC IMPACT STUDY FINAL
REPORT OUTLINE**

PART ONE: TRAFFIC IMPACT STUDY

- I. INTRODUCTION**
- II. TRAFFIC DATA COLLECTION AND INVENTORY**
 - A. Critical roadway segments/intersections
 - B. Existing traffic volumes
 - C. Traffic control devices
 - D. Functional classifications
- III. PROJECT GENERATED TRAFFIC**
 - A. Trip generation
 - B. Pass By/Diverted Traffic and internal circulation
 - C. Trip distribution and assignment
- IV. TRAFFIC ANALYSIS**
 - A. Methodology
 - B. Existing level of service
 - C. Future level of service
 - D. Mitigation Measures
 - E. Traffic signal warrant analysis (if required)
- V. TRAFFIC IMPACT CONCLUSIONS**

PART TWO: AIR QUALITY ANALYSIS

I. AIR QUALITY PROCEDURES

II. FINDINGS AND RECOMMENDATIONS

PART THREE ; APPENDICES

A. Existing traffic count data

B. Expected traffic count data

1. Future without proposed development

2. Future with proposed development

C. Existing capacity analysis results

D. Expected capacity analysis results

1. Future without proposed development

2. Future with proposed development

3. Future with proposed development and mitigation measures.

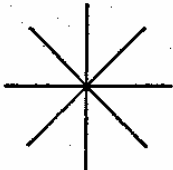
E. Traffic signal warrant analysis (if necessary)

F. Air Quality modeling printouts with input

**APPENDIX D
SAMPLE FORMS**

TRAFFIC COUNT

GRAPHIC SUMMARY SHEET



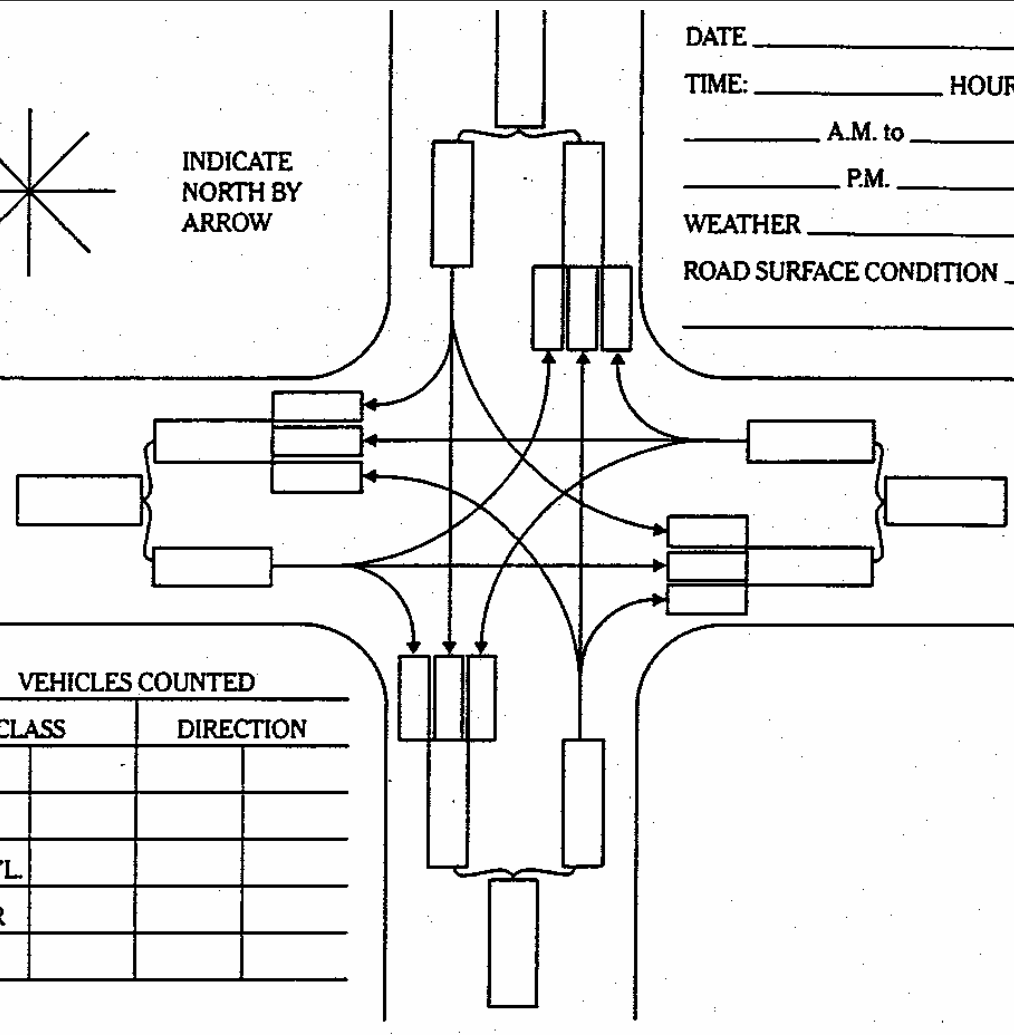
INDICATE
NORTH BY
ARROW

DATE _____

TIME: _____ HOURS FROM
_____ A.M. to _____ A.M.
_____ P.M. _____ P.M.

WEATHER _____

ROAD SURFACE CONDITION _____



VEHICLES COUNTED			
CLASS	DIRECTION		
ALL			
PASS.			
COMM'L.			
OTHER			

REMARKS: _____

FIGURE 1

JEFFERSON COUNTY PUBLIC WORKS AND TRANSPORTATION DIVISION
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VEHICLE TURNING MOVEMENTS

PROJECT _____
 INTERSECTION _____
 COMPLETION YEAR _____ TIME _____

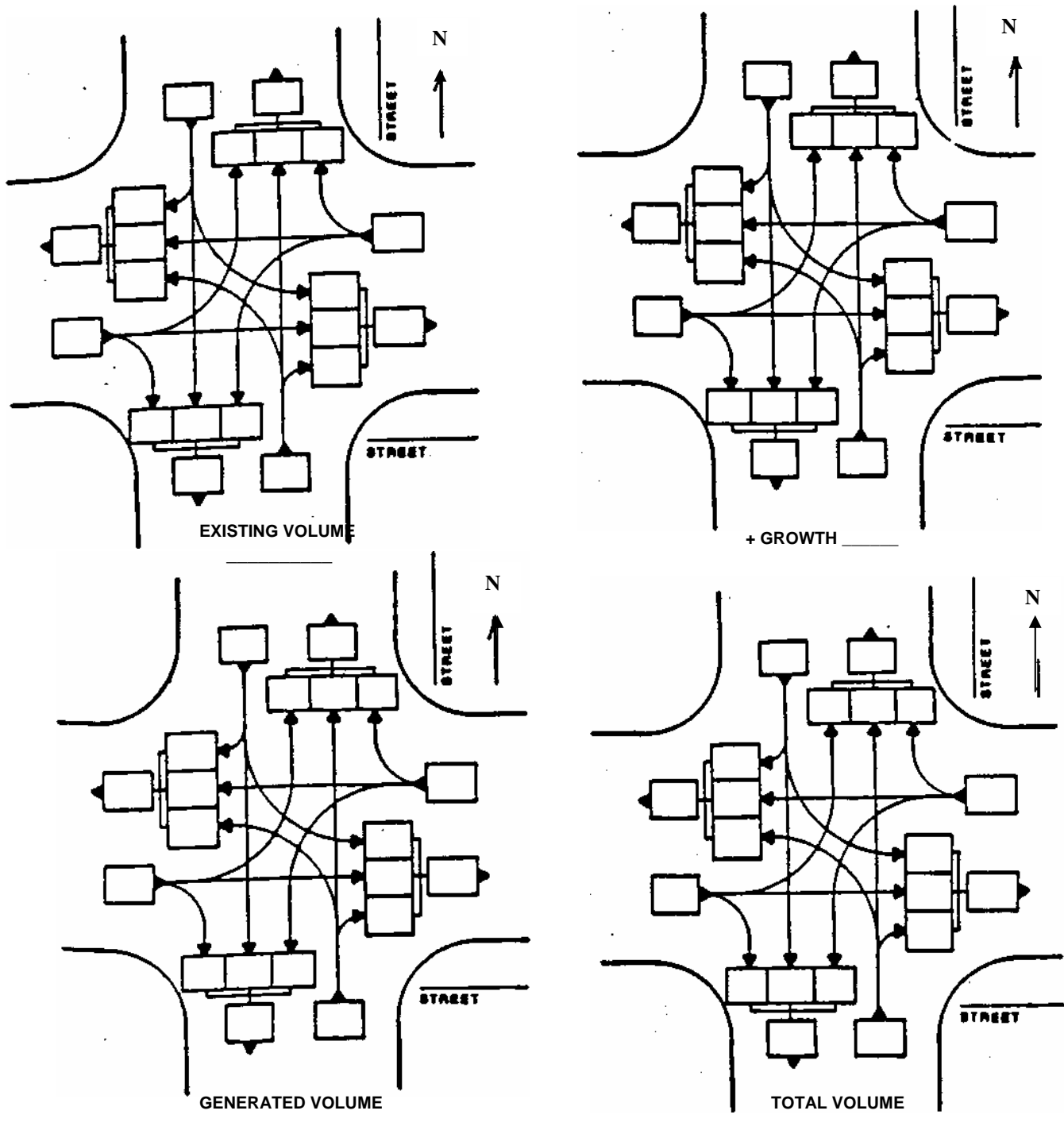


FIGURE 2

JEFFERSON COUNTY PUBLIC WORKS AND TRANSPORTATION DIVISION
 AND AIR POLLUTION CONTROL DISTRICT OF JEFFERSON COUNTY

LDC Guidelines for Traffic Impact Studies and Air Quality Analysis

Appendix 6E

TRAFFIC SIGNAL WARRANTS ANALYSIS FORM

Major Street _____ Critical Approach Speed _____ mph Lanes _____

Minor Street _____ Critical Approach Speed _____ mph Lanes _____

Speed of major street traffic > 40 mph

70% VOL.
YES

100% VOL.
NO

In built up area of isolated community of < 10,000 pop.

YES

NO

Applicable Minimum Volume Requirements:

70%

100%

WARRANT 1 — Minimum Vehicular Volume

	Minimum Requirements (80% Shown in Brackets)														YES	NO
	100%	70%	100%	70%												
Approach Lanes	1		2 or more													
					1	2	3	4	5	6	7	8				
Both Approaches	500	350	600	420												
Major Street	(400)	(280)	(480)	(336)												
Highest Approach	150	105	200	140												
Minor Street	(120)	(84)	(160)	(112)												

TIME PERIOD FROM _____ M TO _____ M

WARRANT 2 — Interruption of Continuous Traffic

	Minimum Requirements (80% Shown in Brackets)				<div>100% SATISFIED</div> <div>80% SATISFIED</div> <div>YES NO</div>							
	IO0%	70%	IO0%	70%								
	1		2 or more									
Approach Lanes					I	2	3	4	5	6	7	8
Both Approaches	750	525	900	630								
Major Street	(600)	(420)	(720)	(504)								
Highest Approach	75	53	100	70								
Minor Street	(60)	(42)	(80)	(56)								

TIME PERIOD FROM _____ M TO _____ M

FIGURE 3

JEFFERSON COUNTY PUBLIC WORKS AND TRANSPORTATION DIVISION
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APPENDIX E
AIR POLLUTION CONTROL DISTRICT
EMISSION FACTORS

Emission factors for air quality analysis in Jefferson County are presented in the following tables. Table E-1 contains the carbon monoxide emission factor during the operating mode (when vehicle is in motion) and Table E-2 shows the emission factors to vising when the vehicles are in the idling mode of operation. The factors are provided by the Air Pollution Control District and may not be changed without prior approval. The factors were generated using MOBILE 5a and MOBILE 4. Ic.

TABLE E-1

**CO EMISSION FACTORS
(GRAMS PER MILE)
1990- 2000**

MOBILE 5a (Version 26 Mar 93) Emission Factors -Carbon Monoxide (CO)
SIP 93 Method 07-27-93 Composite Emission Factors
WINTER Jefferson County

GM/MI @ MPH	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
3	233.533	217.272	199.029	177.538	166.651	138.000	131.331	124.476	117.334	110.642	105.354
4	179.842	167.317	153.561	137.290	129.070	107.053	101.968	96.792	91.472	86.494	82.555
5	146.370	136.359	125.478	112.528	106.016	88.125	84.056	79.936	75.747	71.830	68.725
6	123.499	115.274	106.388	95.732	90.403	75.326	71.964	68.570	65.151	61.958	59.420
8	94.368	88.461	82.136	74.410	70.602	59.100	56.652	54.192	51.753	49.480	47.660
10	76.715	72.201	67.426	61.470	58.583	49.241	47.351	45.460	43.619	41.903	40.519
12	64.943	61.336	57.586	52.801	50.523	42.615	41.100	39.591	38.150	36.808	35.713
14	56.555	53.577	50.552	46.592	44.745	37.857	36.610	35.374	34.219	33.144	32.256
16	50.267	47.753	45.267	41.922	40.396	34.272	33.225	32.195	31.255	30.381	29.649
18	45.357	43.207	41.139	38.274	36.998	31.470	30.580	29.711	28.939	28.222	27.613
20	41.495	39.618	37.846	35.309	34.197	29.110	28.310	27.529	26.852	26.233	25.695
25	34.687	33.026	31.443	29.186	28.147	23.823	23.059	22.297	21.587	20.905	20.312
30	29.951	28.492	27.064	25.025	24.052	20.262	19.531	18.788	18.059	17.342	16.720
35	26.565	25.259	23.945	22.065	21.141	17.734	17.026	16.296	15.552	14.809	14.165
40	24.198	22.971	21.719	19.936	19.033	15.894	15.195	14.467	13.707	12.938	12.274
45	22.612	21.386	20.150	18.407	17.502	14.540	13.834	13.099	12.319	11.522	10.833
50	21.955	20.702	19.458	17.718	16.801	13.912	13.196	12.450	11.655	10.840	10.136
55	22.087	20.821	19.564	17.811	16.886	13.983	13.259	12.506	11.705	10.885	10.176
60	41.464	38.352	35.354	31.501	29.316	23.726	22.099	20.438	18.782	17.144	15.764
65	61.001	56.028	51.273	45.307	41.852	33.557	31.017	28.441	25.921	23.460	21.405
I/HR IDLE	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
	695.282	647.185	593.062	529.524	497.456	411.267	391.261	370.839	349.449	329.468	313.411

JEFFERSON COUNTY PUBLIC WORKS AND TRANSPORTATION DIVISION
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TABLE E-1 (CONTINUED)

**CO EMISSION FACTORS
(GRAMS PER MILE)
2000-2010**

MOBILE 5a (Version 26 Mar 93) Emission Factors -Carbon Monoxide (CO)
SIP 93 Method 07-27-93 Composite Emission Factors
WINTER Jefferson County

GM/MI @ MPH	2000	2002	2004	2006	2008	2010	2012	2014	2016	2018	2020
3	105.354	99.169	95.120	92.714	91.138	90.018	88.161	88.051	87.977	87.914	87.88
4	82.555	77.929	74.926	73.145	71.972	71.149	69.851	69.764	69.705	69.657	69.62
5	68.725	65.065	62.703	61.298	60.370	59.726	58.731	58.660	58.611	58.569	58.54
6	59.420	56.417	54.489	53.338	52.573	52.049	51.236	51.174	51.131	51.096	51.07
8	47.660	45.495	44.118	43.287	42.730	42.356	41.735	41.684	41.649	41.620	41.60
10	40.519	38.862	37.822	37.187	36.755	36.472	35.937	35.894	35.864	35.839	35.82
12	35.713	34.397	33.585	33.084	32.735	32.515	32.022	31.983	31.957	31.934	31.92
14	32.256	31.185	30.538	30.132	29.844	29.667	29.197	29.162	29.138	29.117	29.10
16	29.649	28.763	28.240	27.906	27.664	27.520	27.063	27.030	27.008	26.988	26.97
18	27.613	26.871	26.445	26.168	25.962	25.843	25.395	25.365	25.343	25.325	25.31
20	25.695	25.028	24.646	24.395	24.205	24.099	23.665	23.634	23.614	23.596	23.58
25	20.312	19.562	19.120	18.836	18.631	18.504	18.151	18.121	18.105	18.091	18.08
30	16.720	15.921	15.440	15.133	14.918	14.776	14.483	14.454	14.440	14.430	14.42
35	14.165	13.330	12.821	12.498	12.275	12.123	11.879	11.851	11.838	11.830	11.82
40	12.274	11.406	10.872	10.536	10.307	10.147	9.9948	9.920	9.910	9.902	9.89
45	10.833	9.931	9.375	9.029	8.794	8.628	8.472	8.445	8.435	8.429	8.42
50	10.136	9.211	8.642	8.289	8.053	7.883	7.762	7.734	7.725	7.720	7.71
55	10.176	9.245	8.672	8.318	8.081	7.910	7.816	7.789	7.779	7.774	7.77
60	15.764	13.954	12.820	12.127	11.672	11.351	11.141	11.098	11.085	11.077	11.07
65	21.405	18.707	17.007	15.975	15.302	14.828	14.530	14.471	14.454	14.444	14.43
I/HR IDLE	2000	2002	2004	2006	2008	2010	2012	2014	2016	2018	2020
	313.411	294.734	282.911	275.633	270.664	267.293	258.158	257.826	257.607	257.425	257.33

All Rates are subject to future modification by the Air Pollution Control District as new information becomes available.

TABLE E-2

(Derivation of above values is described below under Table E-2)

JEFFERSON COUNTY PUBLIC WORKS AND TRANSPORTATION DIVISION
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**CO IDLE EMISSION FACTORS
(GRAMS PER MINUTE)**

1990-2010

24 Feb 1992 MOBILE version 4.1c (4 Nov 91)

YEAR	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
IDLE	9.019	8.111	7.354	6.735	6.214	5.708	5.191	4.734	4.349	4.050	3.781
YEAR	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
IDLE	3.781	3.558	3.380	3.245	3.068	2.994	2.929	2.867	2.836	2.794	2.773

All Rates are subject to future modification by the Air Pollution Control District as new information becomes available.

Derivation of Tables E-1. and E-2;

Vehicle emissions per mile and idle emissions per minute from results of MOBILE 5a and MOBILE 4.1c (version of 4 Nov 91) model runs as prepared by APCDJC personnel to reflect reasonable predictions of future emissions rates. MOBILE 5a model default registration distribution is used. RVP of local gasoline is set to 15.0 as a realistic winter supply condition. The temperature used by the model was 28.5 degrees Fahrenheit, determined to be the average minimum daily temperature for January 1992, and reflects reasonable expectations of real-world low temperatures (CO emissions go up when temperature goes down).

The model assumed that an inspection/maintenance program equivalent to the EPA minimum performance-based standard is implemented for all vehicles in the area for all years. This specification does not take into account local improvements over title minimum I/M program but is realistic and meaningful, since the Clean Air Act mandates the minimum specification or better in all covered areas, and thus emission rates should be NO HIGHER than those shown. Using the minimum standard allows for more stable predictions of the future, since as-yet-undetermined program variations are ignored.

These assumptions should be adequate for the intended purpose of evaluating individual land-use or transportation projects. Only changes in the MOBILE model version should bring about a need to revise these rate tables.

**APPENDIX F TECHNICAL
REFERENCE**

Manual of Traffic Engineering Studies. Box, Paul C. and Joseph C. Oppenlander, Institute of Transportation Engineers, Washington, D.C., 1976

Quick Response Urban Travel Estimation Techniques and Transferable Parameters: User Guide. NCHRP Report 187, Sosslau A.B., et al., National Cooperative Highway Research Program, Transportation Research Board, 1978.

Trip Generation. 5th edition, Institute of Transportation Engineers, Washington, D.C., 1991

Local Trip Generation Study. Barton Aschman Associates, Inc., October 1993,

Development and Application of Trip Generation Rates, Mehra, Joe and C. Richard Keller, Federal Highway Administration, Washington, D.C. 1985.

Highway Capacity Manual. Special Report 209, Transportation Research Board, Washington, D.C., 1985.

Manual on Uniform Traffic Control Devices. National Committee on Uniform Traffic Control Devices, U.S. Department of Transportation, Federal Highway Administration, 1978.

Transportation and Traffic Engineering Handbook. 2nd. Edition, Institute of Transportation Engineers, Washington, D.C., 1982.

User's Guide to CAL3OHC. U.S. Environmental Protection Agency, Technical Support Division, Research Triangle Park, N.C. July, 1990.

Traffic Engineering Handbook. 4th edition, Institute of Transportation Engineers, Washington, D.C. 1992

Transportation Planning Handbook. 1st edition Institute of Transportation Engineers, Washington, D.C., 1992